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**SOME STUDIES ON OVINE AND CAPRINE  
CYRTOSPORIDIOSIS CONCERNING PREVALENCE  
AND ELECTROPHORETIC PATTERN OF  
BLOOD SERUM PROTEIN**  
(With 6 Tables and 2 Figures)

By

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بعض الدراسات عن مرض كريتوسبوريدبوزس الأغنام والماعز  
من حيث معدل الانتشار و الفصل الكهربائي لبروتينات الدم

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شملت هذه الدراسة عدد ٣٢٠ حيوانا من المجرترات الصغيرة ، منها عدد ٢٠٠ حول ، ١٠٠ جدى كترأوح أعمارها من ٥-٣٠ يوما بالإضافة إلى ١٠ من الأغنام وعشرة من الماعز البالغة وذلك لمعرفة مدى معدل انتشار طفيل الكريتوسبوريديم في هذه الحيوانات وذلك بالكشف عن حويصلات الطفيل في براز هذه الحيوانات باستخدام صبغة الداى ميثيل سلفوكسيد. هذا وقد أظهرت نتائج الفحص الطفيلي أن معدل الإصابة بطفيل الكريتوسبوريديم كانت بنسبة ١٣,٣% ، ٥,٤٥% في الأغنام والماعز على الترتيب. كما أظهر الفحص الإكلينيكي لسحالات المرضية المصابة بالطفيل عن وجود درجات متفاوتة من الأسهال مع فقدان للشهية ونقص رضاعة اللبن وضعف عام مع إنخفاض في الوزن الحى للحيوان مع وجود جفاف بدرجات متفاوتة طبقا لمعدل الإصابة مع ملاحظة عدم وجود ارتفاع في درجة حرارة هذه الحيوانات. وقد أظهرت صورة الدم وجود نقص معنوي في كل من عدد كرات الدم الحمراء في المليتر المكعب من الدم علاوة على نقص كمية هيموجلوبين الدم وعلى السقيض فقد كانت هناك زيادة معنوية في كل من عدد كرات الدم البيضاء في الحيوانات المصابة مقارنة بالسليمة. أما فحص سيرم الدم فقد أظهر وجود نقص معنوي في بروتين الدم الكلى وكذلك في الجلوبيولين العام والجاما جلوبيولين في الحيوانات المصابة مقارنة بالسليمة.

## SUMMARY

320 animals were investigated in this study of them 200 lambs and 100 kids aging 5 to 30 days, the remaining 20 were clinically healthy adults (10 sheep and 10 goats) to determine the prevalence of cryptosporidiosis in small ruminants. Dimethyl sulphoxide Ziehl Neelsen stain was used to detect cryptosporidium oocysts in faecal smears. The investigation revealed that, cryptosporidium infection was detected in 13.3% of the examined sheep and 5.45% of examined goats. The most important clinical signs in ovine and caprine cryptosporidiosis were mild to profuse watery diarrhoea, inappetence, loss of live body weight, weakness and dehydration, however the infected animals showed normal body temperature. Haemoglobin contents and total erythrocytic count of diseased animals were significantly decreased meanwhile an increased in the packed cell volume (PCV), total leukocytic count together with decreased total blood serum protein were evident. Total globulin and  $\gamma$ -globulin revealed significant decrease in both infected lambs and kids, but other protein fractions showed insignificant alterations.

*Key words: Sheep, goat, Cryptosporidiosis, Blood serum protein.*

## INTRODUCTION

Neonatal diarrhoea is one of the main causes of morbidity and mortality in young ruminants. *Cryptosporidium parvum* is considered as one of the main causative agents of diarrhoea at this age (Koudela and Bokova, 1997 and Koudela and Vitovec, 1997). *Cryptosporidium* contribute to cause high morbidity and mortality in neonatal kids and lambs especially under stress conditions or in association with other enteropathogens (Johnson *et al.*, 1999; Fatheia Khalil, 2000 and El-Gaml *et al.*, 2001). Most clinical reports indicated that, infection and faecal shedding of cryptosporidial oocysts are limited to lambs and kids less than one month old (Tzipori *et al.*, 1982; Foreyt, 1990 and Majewska *et al.*, 2000).

Most data on the prevalence of cryptosporidium infection in farm animals concern cattle. In comparison, the available literatures lack information on the occurrence of cryptosporidiosis in sheep and goats (Casemore *et al.*, 1997 and Ortega-Mora *et al.*, 1999).

*Cryptosporidium* species were first described in goats in Tasmania (Mason *et al.*, 1981), subsequently other parts of Australia

(Tzipori *et al.*, 1982) Europe (Thamsborg *et al.*, 1990) and South America (Vieira *et al.*, 1997). In Egypt, sheep and goats are considered the main integral part of the farming system for the small farmers, so the goal of this investigation was to throw a light on the prevalence of cryptosporidiosis in sheep and goats, clinical and hematological pictures together with the changes in electrophoretic pattern of blood serum protein accompanying such condition.

## **MATERIALS AND METHODS**

### **1. Animals:**

A total number of 320 animals were included in the present investigation. 200 out of them were lambs and 100 were kids aging 5-30 days. The remaining 20 animals were clinically healthy adults (10 sheep and 10 goats). All animals belonged to private farms (Badw flocks). This survey was carried out in the period from January 2001 to December 2001 in Dakahlia governorate.

### **2. Blood samples:**

Two bloods samples were collected from each animal through jugular vein puncture. The first one was with heparin as anticoagulant for complete haemogram using computed electronic cell counter (MS9, France). The second blood sample was without anticoagulant to obtain clear, non haemolysed sera for the determination of blood serum total protein and its electrophoretic patterns according to Josephson and Gyllensward (1957) and Stegmann *et al.* (1987), respectively.

### **3. Faecal samples:**

Individual faecal samples were collected from all examined animals using test tube or clinical thermometer for making a thin faecal smear which were left to dry then fixed with methanol for 10 minutes. The fixed smears were stained using Dimethyle sulphoxide Ziehl Neelsen stain according to Pohjola *et al.* (1984). Finally the smears were screened under oil immersion magnification. All the parasitological examinations were carried out at the Department of Animal Medicine, Faculty of Veterinary Medicine, Kafr El-Sheikh, Tanta University.

### **4. Clinical examination:**

Complete clinical history and clinical examination were carried out on each animal according to Kelly (1984) to ensure their healthy status.



5. Statistical analysis:

Statistical analysis of the obtained data were done using students-t-test (Ronser, 1990).

RESULTS

*Cryptosporidium parvum* infection was detected in 28 (13.3%) out of the examined sheep, where the infection was detected in 25 (16.6%) out of the examined diarrhoeic lambs, 3 (6%) out of the non diarrhoeic ones and zero % in adult sheep (Table 1).

Table 1: Prevalence of cryptosporidiosis in examined lambs and sheep.

Animal status	No. of examined animals	No. of infected animals	Infection rate %
Diarrhoeic lambs	150	25	16.66
Healthy lambs	50	3	6.0
Adult sheep	10	Zero	Zero
Total	210	28	13.3

In goats, *Cryptosporidium parvum* infection was detected in 6 (5.45%) out of the examined goats, where the infection was 5 (6.25%) among the diarrhoeic kids and 1 (5%) in healthy ones, whereas no cryptosporidium was detected in adult goats (Table 2).

Table 2: Prevalence of cryptosporidiosis in examined goat kids and goats.

Animal status	No. of examined animals	No. of infected animals	Infection rate %
Diarrhoeic kids	80	5	6.25
Healthy kids	20	1	5.0
Adult goats	10	zero	Zero
Total	110	6	5.45

Clinical manifestations observed in the affected animals in the present investigation included mild to profuse watery to yellow diarrhoea, reduce milk suckling, weakness, losses of live body weight loss and varying degree of dehydration according to the severity of signs.

Table 3. Haemogram picture of examined lambs.

Animal status	Leukocytes x 10 <sup>9</sup> /µl	Monocytes %	Lymphocytes %	Granulocytes %	R.B.Cs x 10 <sup>12</sup> /µl	Hb (g/dl)	PCV (%)	MCH (pg)	MCHC (g/c)	MCV (fl)	Platelet x 10 <sup>9</sup> /mm <sup>3</sup>
Healthy lambs	8.21 ± 1.99	4.3 ± 0.2	50.2 ± 4.2	45.5 ± 0.8	10.8 ± 0.3	11.1 ± 1.2	38.0 ± 1.5	12.9 ± 1.2	34.1 ± 3.3	35.2 ± 1.8	380 ± 20
Diarrhoeic infected lambs	12.60 ± 0.8*	4.6 ± 0.3	60.3 ± 3.2	35.5 ± 1.2***	9.61 ± 0.2**	7.2 ± 0.3***	45.2 ± 2.1*	10.1 ± 1.2	33.5 ± 1.1	35.38 ± 1.3	400 ± 30

Table 4. Haemogram picture of examined kids.

Animal status	Leukocytes x 10 <sup>9</sup> /µl	Monocytes %	Lymphocytes %	Granulocytes %	R.B.Cs x 10 <sup>12</sup> /µl	Hb (g/dl)	PCV (%)	MCH (pg)	MCHC (g/dl)	MCV (fl)	Platelet x 10 <sup>9</sup> /mm <sup>3</sup>
Healthy kids	10.2 ± 0.4	3.8 ± 0.2	50.2 ± 1.2	46.3 ± 1.2	10.2 ± 0.3	10.85 ± 1.5	31.9 ± 2.5	11.1 ± 2.1	35.11 ± 2.1	33.3 ± 2.1	410 ± 25
Diarrhoeic infected kids	11.1 ± 0.2*	4.2 ± 0.5	57.1 ± 2.2	39.1 ± 2.1**	9.0 ± 0.4*	7.1 ± 0.3*	40.1 ± 2.8*	10.1 ± 3.2	35.22 ± 1.1	34.1 ± 1.2	420 ± 30

\* Significant changes (P < 0.05)

\*\* Highly significant changes (P < 0.01)

\*\*\* Very highly significant changes (P < 0.001)

Infected lambs and kids showed normal rectal temperature (38.4-39.8°C), accelerated heart rate (120-155/m), and slightly pale mucous membranes indicating anaemia.

Haematological examinations revealed reduction in erythrocytic cell count and haemoglobin contents in infected lambs and kids. On the contrary, packed cell volume, total leukocytic count, lymphocytes and granulocytes were significantly increased in infected lambs and kids. On the other hand, monocytes, mean corpuscular haemoglobin concentration and mean corpuscular volume showed non significant variations among infected and non infected groups (Tables 3, 4 and Figure 1).

Regarding, total blood serum protein and its electrophoretic pattern this investigation revealed significant decrease in the total blood, serum protein, total globulin and  $\gamma$ -globulin, while other fractions revealed insignificant alterations in both infected lambs and kids, (Tables 5, 6 and Figure 2).

**Table 5:** Blood serum protein electrophoresis in healthy and diseased lambs.

Fraction	Healthy lambs (N = 10)	Diseased lambs (N = 10)
Total protein (g/dl)	9.1 ± 0.7	7.3 ± 0.16*
Albumin (g/dl)	3.07 ± 0.8	2.81 ± 0.5
Globulin (g/dl)	6.03 ± 0.9	4.49 ± 0.09***
A/G ratio	0.61 ± 0.034	0.63 ± 0.03
$\alpha$ -globulin (g/dl)	1.69 ± 0.15	1.27 ± 0.12
$\beta$ -globulin (g/dl)	0.93 ± 0.16	1.08 ± 0.12
$\gamma$ -globulin (g/dl)	3.41 ± 0.025	2.14 ± 0.09***

**Table 6:** Blood serum protein electrophoresis in healthy and diseased kids.

Fraction	Healthy lambs (N = 5)	Diseased lambs (N = 5)
Total protein (g/dl)	9.1 ± 0.7	6.9 ± 0.37*
Albumin (g/dl)	3.07 ± 0.3	2.56 ± 0.2
Globulin (g/dl)	6.03 ± 0.3	4.34 ± 0.5**
A/G ratio	0.51 ± 0.040	0.59 ± 0.045
$\alpha$ -globulin (g/dl)	1.69 ± 0.15	1.29 ± 0.18
$\beta$ -globulin (g/dl)	0.93 ± 0.06	0.78 ± 0.02*
$\gamma$ -globulin (g/dl)	3.41 ± 0.025	2.27 ± 0.02***

\* Significant changes (P < 0.05)

\*\* Highly significant changes (P < 0.01)

\*\*\* Very highly significant changes (P < 0.001)

## DISCUSSION

Cryptosporidiosis is an enteric disease that is generally a disease of intestinal tract primarily of neonatal farm animals especially calves, characterized by diarrhoea of varying degree. The appearance of the disease in sheep and goats, however is generally accepted to be limited to very young animals, with most being at less than two weeks of age, but adults are considered to be refractory to both infection and disease (Johnson *et al.*, 1999, Matthews, 1999, Fatheia Khalil, 2000 and El-Gaml *et al.*, 2001).

In this investigation, the prevalence of cryptosporidiosis in the examined lambs (5-30 days old ) was 11%, whereas it was zero % in adult sheep. Similar findings were reported by Majewska *et al.* (2000). Also, similar age predisposition was observed in previous study by Xiao *et al.* (1993) and Fatheia Khalil (2000). On the other hand, these results disagree with those recorded by Abou El-Hassan (1996) and Olson *et al.* (1997), who demonstrated that the prevalence of the parasite was greater in animals older than 6 months. Higher prevalence rates were reported by Xiao *et al.* (1993), Munoz-Fernandez *et al.* (1996), Abou EL-Hassan (1996), Olson *et al.* (1997) and Fathcia Khalil (2000). The differences in the prevalence may be attributed to either the weather variations, environmental contamination or hygiene in each environment as it had been demonstrated by Tzipori (1983).

Concerning cryptosporidiosis in goats, the prevalence of infection was 6% in examined kids and zero % in adult goats. A similar prevalence was observed by Radwan (1996). Also, this investigation revealed, that the disease was common only in kids of less than one month of age. These results were in accordance with those reported by Tzipori *et al.* (1981), Angus (1990), Munoz-Fernandez *et al.* (1996) and Majewska *et al.* (2000). On the other hand, this observation contradicts with those previously recorded by Card *et al.* (1987), Johnson *et al.* (1999) and Noordeen *et al.* (2000) who detected cryptosporidium in a wide range of age groups extending from two weeks old kids to adult goats of more than one year. Also, higher prevalence rates were recorded in kids by Fatheia Khalil (2000) and El-Gaml *et al.* (2001).

In general, this investigation revealed that cryptosporidiosis is a disease of young animals and a gradual decrease of infection rate occurred with age progression. This observation coincided with those found by Stein *et al.* (1983), Hilali *et al.* (1998) and El-Gaml *et al.*



(2001) who reported that, cryptosporidiosis is most frequently seen in animals between few days and one month of age. Moreover, Fayer, *et al.* (1990) reported that, the incidence of cryptosporidium in diarrhoeic young animals might be due to the fact that young ages are severely affected by this parasite, as far as the young animals are immunologically immature and consequently have a greater susceptibility to the infection by this parasite.

The present study showed that, 6% and 5% of the examined healthy lambs and kids; respectively were infected without any apparent clinical signs, so they may play a major role as a source of infection to others. Similar results were reported by Tzipori *et al.* (1981), Majewska *et al.* (2000) and Noordeen *et al.* (2000).

The most commonly observed clinical signs in ovine and caprine cryptosporidiosis in this investigation mainly mild to profuse watery diarrhoea which lasted for 3-7 days; decrease milk suckling, weakness, weight loss and dehydration in addition to tenesmus which was also evident in some cases. This was in agree with the findings of Matos-Fernandez *et al.* (1993); Ortega-Mora and Wright (1994), Muroz-Fernandez *et al.* (1996); Koudela and Jiri (1997), Johnson *et al.* (1999), Fatheia Khalil (2000), Viu *et al.* (2000) and El-Gaml *et al.* (2001). Diarrhoea was greatly attributed to wide spread of infection to the villous epithelium particularly in the distal jajunum and ileum, with a tendency for the spread of infection down to the caecum and spiral colon and sometimes to the rectum. Such heavy infection resulted in loss of normal epithelium with replacement by a non absorptive cuboidal epithelium with subsequent atrophy of the intestinal villi, villous fusion, cryphyperplasia with final dramatic malabsorption and hyper secretion leading to the occurrence of diarrhoea (Chermette and Boufassa-Quzrot, 1988 and Blewett and Angus, 1994).

Reviewing the available literatures, it has been found that less attention was paid concerning the effect of cryptosporidiosis on haematological picture in animals particularly lambs and kids. The occurrence of significant reduction in both total erythrocytic cell counts/mm<sup>3</sup> blood and haemoglobin contents and the significant increase in PCV and mean corpuscular haemoglobin of infected animal may be greatly attributed to the incidence of dehydration and haemoconcentration arised from diarrhoea. These results came in agreement with those previously reported by Molina *et al.* (1994) and Al-Khodery (1996). Furthermore the significant increase in total



leukocytic count/mm<sup>3</sup> blood, lymphocytes and granulocytes percents in the blood of infected animals when compared with healthy ones agreed with the postulate of Molina *et al.* (1994) in that, the infection with cryptosporidia or any protozoa like parasite eventually predispose for bacterial invasion which subsequently leads to increase in the white blood cells.

The obtained results of total blood serum protein and its electrophoretic patterns, showed insufficient available literatures, but the significant reduction in the blood serum total protein, total globulin and gamma-globulin in both infected lambs and kids and the significant decrease in  $\beta$ -globulin of infected kids only when compared with healthy ones these came in agreement with those previously reported by Deptula and Deptula (1989) and Molina *et al.* (1994). The lowered blood serum total protein in gastrointestinal affections may be attributed to the occurring disturbances of protein digestion and absorption (Coles, 1986). In these aspect, Jain (1986) declared that, the loss of protein during inflammation or ulceration of gastrointestinal tracts could lead to impaired absorption as well as increased protein loss due to injured mucosal cells. Barton, (1978) found that, this mechanism may be potentiated by intestinal parasites. Finally it could be concluded that, cryptosporidial infection must be considered in diarrhoeic lambs and kids less than one month of age causing major alterations in total erythrocytic count/mm<sup>3</sup> blood and haemoglobin contents in addition to some blood serum changes in electrophoretic patterns accompanied such infection.

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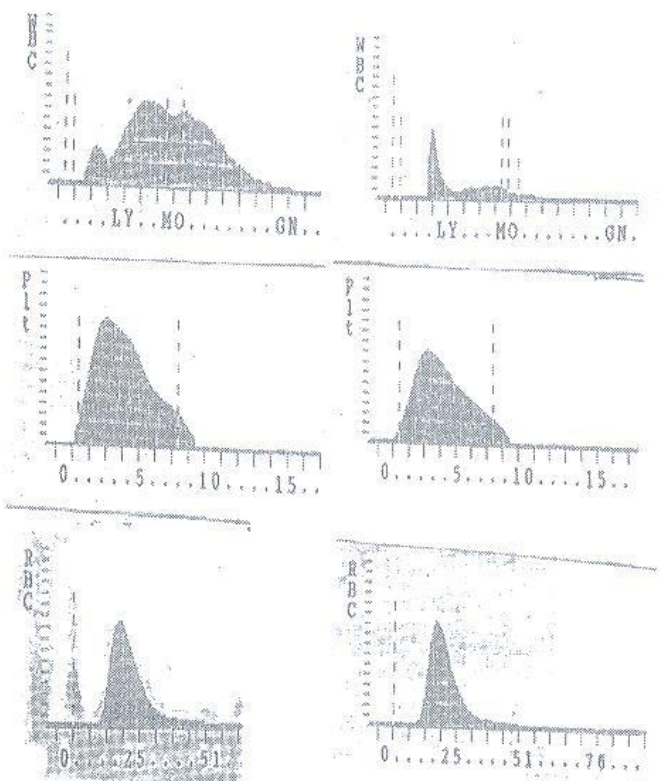


Fig. 1. Haemogram of clinically healthy (A) and cryptosporidium infected (B) animals.

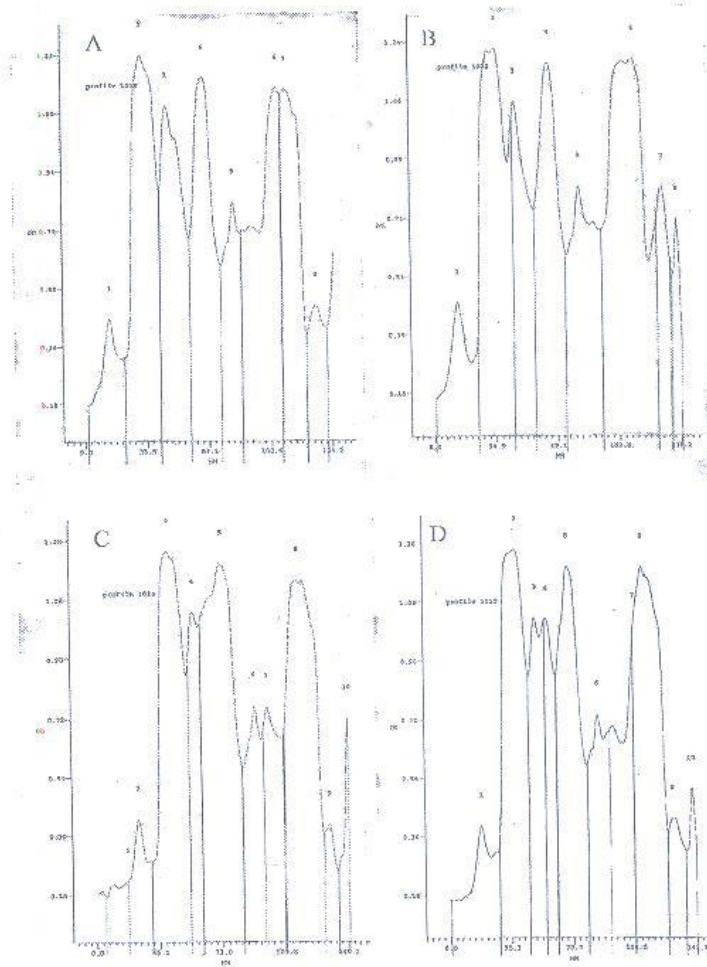


Fig. 2. Total blood serum protein electrophoresis in clinically healthy (A), infected lambs (B), healthy (C), and infected kids (D)